ATTACHMENT 6

These are the questions the MAT team under Harry Montgomery would like for SBRC to address. We are hoping that Tom Pagano might be able to briefly respond to them next week when he is here for the Science Team meeting. We expect to forward these to SBRC Friday afternoon unless informed otherwise.

GENERAL

1. Several issues were raised in the Calibration Televideoconference right after the CDR (documented in PL3095-N03500). These have not yet been formally addressed. Is there going to be an formal reply? If not, SBRC and GSFC should agree on which items from that list are still issues that need attention.

2. When will details on the engineering telemetry (contents, and how often individual elements are read out, etc.) be available?

SRCA QUESTIONS

1. The SRCA specification 151788 does not show the Reference SiPD in use during the spatial and radiometric modes. Will this point be included in the telemetry during these two modes?

2. Our analysis of the SRCA spatial mode used with the along-track reticles indicates that it may be worthwhile to implement the scan direction phase delay here as well (as with the scan direction reticles where it is currently in the plan). Are there any hardware or flight software restrictions that would prevent MCST from implementing this delay?

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3. The lamp conversion efficiency is given in PL3095-Q03202 as 0.45 for a color temperature of 2670 K and 0.65 for a color temperature of 2150 K. In PL3-95-Q03178, these are given as 0.39 and 0.45 respectively. What is the correct value?

4. Several of the equations needed in the operation of the SRCA (specifically in the spectral mode) have not been explicitly presented in CDRL 404 or internal SBRC memos. We have been informed that these are in the SBRC models. At what point will we be able to get access to this information?

5. For the SRCA, the Standard Calibration Detector is listed as a SiPD. Will this cut off, or have unacceptable responsivity for the bands greater than 1 um?

SD and SDSM QUESTIONS

1. The SDSM specification 151791 states that the view requirements are designed to allow up to 120 seconds of calibration time (p. 5). Is this an absolute maximum use of the SD/SDSM?

2. The SD and SDSM specifications (151789 and 151791) both state that the usage frequency is limited by thermal and power constraints (footnote, p. 2). What is the nature of these constraints?

3. SD BRDF measurements have been outlined in memos by Jim Young. With the replan, what is the status of these measurements, when will the data be available, and what wavelengths will these measurements be made at?

4. Do the BRDF studies (or operation of the SD/SDSM) account for any effects of different footprints on the SD? I.e., the SDSM and MODIS will not see the same SD area. Will stray light, etc. be a concern?

5. When will GSFC be able to get access to the information in the SD/SDSM radiometric models?

6. The transmission of the SD screen is 8.5%. What uncertainty is associated with this number?

7. Will the transmission of the screen be measured directly over the entire range of solar angles?

8. When will the SD screen design be completed?

BB QUESTIONS

1. Will emissivity for the in-flight blackbody be measured as a function of wavelength?

2. What are the dimensions of the elliptical projection of the aperture on the blackbody? I.e., what is the location of the thermistors with respect to data frame and channel?

3. Will the sun be able to enter the scan cavity through the earth aperture at oblique angles during the beginning and end of satellite day? If not, what prevents this occurance?

4. Can earthshine be directly incident on the blackbody?

THERMAL CALIBRATION

1. Does SBRC plan to collect, at any time during ground testing, the signal from a full scan of the cavity (all the housing)? Does SBRC plan to collect any narcissus measurements (when the scan mirror is at a view angle of 284 degree so that the detectors see themselves)?

2. Will SBRC make any characterizations of the optics transmissions as a function of temperature?

3. When will GSFC get the "consent to integrate" data packages from SBRC for the PC detectors? Data of interest includes cadmium concentration, detector dimensions, electrical length, photoconductive lifetime, contact and lead resistance, bias current, quantum efficiency, background irradiation at the detector, and field of view used for measurements.

4. What effects will the detector temperature have on: resistance, carrier mobility, free electron concentration, donor and acceptor concentrations, noise vs. frequency, d-star and responsivity vs. wavelength, nonlinear response? Is this addressed in the "consent to integrate" data packages?

5. What long term detector stability data does SBRC have?

DC RESTORE

1. What is the number of bits in the DC offset values and how many bits are included in the telemetry?

2. How many counts will the MODIS signal change in the most sensitive channel with a single bit change of the offset ?

3. How much filtering, and of what type, is used to limit the rate of change of these offsets? I.e. how is this offset computed? What is the deadband?

4. How is the required dynamic range of the DC restore determined? I.e., margins will be required for changes due to life, time, temperature,

etc. How much margin is being allowed?

5. Will the DC restore restrict the range of the single "master curve" for ground calibration?

TESTING

1. Please provide more detail on the testing plans for the thermal bands. How many instrument temperatures, set point temperatures, and BCS temperatures will be used?

2. How will scan dependent radiometric effects be determined with the replan?

3. What are the plans to check the redundancy configurations, particularly in the electronics (power supply, etc.)?

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T. PAGANO 5/3/94

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NASA Questions: MAT Team

General

1) · Informal reply. I brought key response

2) J. Mehrten recently sent NASA Rnd & Tulon CDRL

SRCA Questions

1) ~~TBD I.M.~~ Yes. Available whenever SRCA is on.

2) No restriction on use of scan direction phase delay.

3) TBD E.J. Use Latest.

4) Anything not described in memos for CDRL 404 will not be available until 1995. I would suggest that you check the memos again. Eric documents his work very well.

5) SiPD's cut-off @ 1μm. ~~TBD EJ~~ Rely on PF calibration

SD and SDSM

1) No. Requirement driven by need for viewfactors.

2) Thermal constraints limited since instrument passively thermally controlled. Solar calibration introduces significant thermal load. Uncertain as to nature of power limitations. SDSM power load is not significant and margins exist.

3) The BRDF measurement facility is complete. Measurements will be made using samples from Vendor in the next few months. Measurements on solar diffuser panels in 1995. The Facility measures from 0.4 to 2.5μm in S & P polarizations. Data available in 1995.

4) The effect of varying footprints on the diffuser is not modeled. The diffuser uniformity is expected to be better than what we can measure with the MODIS aperture size. Effects that remain are expected to be characterized during ground cal/check-out and in-flight operation. The SDSM footprint on the solar diffuser approximates the MODIS as well as technologically feasible. Remember the SDSM monitors diffuser stability. It's footprint needs to be stable. No problems anticipated. Very unlikely for diffuser to degrade in an irregular pattern.

Stray

4)...Continued. Stray Light. One of the top risk items on MODIS is solar stray light through the diffuser port. This area is very difficult to baffle to the levels required for MODIS accuracies. This effort is currently underway at SBRC.

5) Information exist in several areas, depending on what you're looking for.

Requirements		SDS/SDSM Specifications
Radiometric Math Model	SD	CDRL 101
(includes ϕ effects, Reflectance Accuracies, Direct/Indirect Solar effects)		
SDSM Screen Analysis	3/94	Brian McKomis Memo

As well as others.

Consult Memo logs. Additional info available in 1995

6) See MSAP CDRL 101 & Requirements document.

TBD T.P. Also see CDR uncertainty budget.

7) No. An analytical model needs to be developed to determine proper screen hole pattern & size. NASA support solicited in this area.

8) 1995.

Blackbody

1) Yes. We are currently defining measurement requirements.

2) I don't know off hand, but I can say that the blackbody temp. uniformity in the non-heated mode is low enough that correction using multiple temperature sensors is not required. In the heated mode, temperature uniformity is marginal and may require some corrections. See CDR data book.

3) No. Sunshades exist on forward ($+x$) and aft ($-x$) sides and $+y$, $-y$ faces of earth viewport. Solar flux will occassionally shine on inside surface of sunshade. This is a concern that is currently being analyzed.

4) Earthshine can be incident on the blackbody. This has been analyzed and it turns out that the radiometric error due to this is within acceptable limits. This term is in the MSAP accuracy model currently.

Thermal Calibration

1) The fixed pattern noise test will acquire almost complete scan cavity and nadir aperture door in all bands. Narcissus information will be possible, but will be similar to space view look. Some limitations exist. See me. Limitations with scan mirror size, and electronic timing.

2) No The temperature ranges anticipated in flight (and test) are not expected to very large. However, our tight requirements may require this knowledge. Effects of optics temperature/emission effects will be characterized in T/V cycling. Finally, we have a background correction algorithm that allows calibration without knowledge of optics transmissione.

3) CTI package already entered in data log. #'s given to Barnes & Montgomery.

4) Effects of detector performance are only partially addressed in the CTI packages. Remember the MODIS FPA will be characterized at the system level over a range of temperatures bounding our nominal set-point of 85 ± 0.2K.

5) I'm not sure how long is meant by "Long Term". It is not readily available to get this data on parts exactly of the MODIS configuration. If data on similar parts is desired, we may be able to find something.

DC Restore

1) PV DC restore offset is applied with ~~8~~ bit accuracy PC DC restore offset is applied with 6 bits in the pre-amp and 6 bits in the post amp. All offset values downloaded, once per scan. This data critical to nonlinearity correction algorithms.

2) The answer is band dependent. PV bands is TBD. PC bands have roughly 100x the fullscale dynamic range of the band. These levels will be set during T/V testing

3) Offset correction applied once per scan at the end of scene data collection based on previous scan's blackbody signal level.

4) PV levels shouldn't change much at all. PC allow for ±10% change in detector resistance. Way more than will ever be needed.

5) DC restore will always bring us to the baseline in the A/D converter. By knowing the levels applied we can analytically back out detector voltages. The gain may limit us, but we will insure that the gains are adequate to cover the dynamic range before we calibrate. Finally, background instrument flux's will limit our ability to calibrate the lower end of the curve. For these measurements, we will need to bring the instrument temperature lower than we would ever anticipate

Testing

1. There will be 2 Thermal cycles on PF (One on EM) See PVS test performance charts, or T. Pagano presentation 5/5/94 on Test & Replan for Instrument and BCS temperatures in T/V. There will be >3 FPA temp set-points during calibration.
2. Ambient measurements of mirror IR reflectance with scan angle and polarization (VIS, NIR, SWIR) will be measured on a rotary table for EM
3. An entire electronic check-out test is planned. OBC's will ~~not~~ be simulated.